

# **SAN JUAN SKYWAY**

**SPATIAL ANALYSIS AND MAPPING**

A Component of the  
**San Juan Skyway Heritage Initiative**

Prepared for :

Town of Rico  
Ouray County  
San Juan County  
San Miguel County  
Montezuma County  
The Trust for Public Land, Denver, CO Office  
Ft. Lewis College Office of Community Services  
The Colorado Department of Local Affairs

Prepared by:

Computer Terrain Mapping, Inc.  
Cloudshadow Consulting  
Spike Productions



# **San Juan Skyway Spatial Analysis and Mapping**

A Component of the  
**San Juan Skyway Heritage Initiative**

**January 2004**

**Prepared for :**

**Town of Rico  
Ouray County  
San Juan County  
San Miguel County  
Montezuma County  
The Trust for Public Land, Denver, CO Office  
Ft. Lewis College Office of Community Services  
The Colorado Department of Local Affairs (DOLA)**

**Prepared by:**

**Computer Terrain Mapping, Inc  
Cloudshadow Consulting  
Spike Productions**



## ACKNOWLEDGMENTS

This document is the product of a collaborative process between numerous agencies, organizations and interested individuals from the beautiful San Juan Skyway region. The individuals listed below contributed their time, energy and effort toward making this project a success. Special thanks goes to Ken Francis of Fort Lewis College, Jim Dietrich of Montezuma County/ Fort Lewis College, Alan Staehle of Ouray County and Pete McKay of San Juan County for their generous contributions of photographic and musical material. Finally, this project would not have been possible without the gracious financial support of the Colorado Department of Local Affairs (DOLA), the Town of Rico, Montezuma County, Ouray County, San Juan County, San Miguel County, the Office of Community Services at Fort Lewis College and The Trust for Public Land.

Bill Ball, Mountain Studies Institute  
Ken Charles, Colorado Dept. of Local Affairs  
Jim Dietrich, Fort Lewis College / Montezuma County  
Vern Ebert, San Miguel County  
Ken Francis, Fort Lewis College  
Ashton Harrison, Town of Rico  
Marlene Hazen, Rico Historical Society  
Eric Heil, Town of Rico  
Linda Luther, San Miguel County  
Peter McKay, San Juan County  
Dick Ostergaard, U.S. Forest Service  
Doug Robotham, The Trust for Public Land  
Judy Schaefer, Rico Planning Commission  
Jack Schoenebaum, Ouray City Council  
Jim Siscoe, Montezuma County  
Alan Staehle, Ouray County  
William Tookey, Silverton/San Juan County  
Scott White, Fort Lewis College  
Nina Williams, Montezuma Land Conservancy

### Consultant Staff

Catherine Russell, Spike Productions  
Ed Russell, Computer Terrain Mapping  
Heidi Ochis, Computer Terrain Mapping  
Geoff Anderson, Cloudshadow Consulting



## CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>iii</b>
<b>INTRODUCTION .....</b>	<b>1</b>
Purpose and Goals .....	2
The San Juan Skyway - Its Resources and Threats .....	3
Physical Setting .....	3
Pre-European Setting .....	4
Historical Context .....	5
<b>PROJECT METHODOLOGY .....</b>	<b>6</b>
Conservation Resources .....	7
Agricultural Resources .....	7
Recreational Resources .....	8
Visual Resources .....	9
Ecological Resources (Wildlife Habitat) .....	9
Watershed Health (Erosion Hazard) .....	10
Proximity to Public Land .....	11
Historical and Archaeological Resources .....	11
Development Potential .....	12
Development Constraints .....	12
Steep Slopes .....	12
Avalanche Hazard .....	13
Geologic Hazards .....	14
Proximity to Roads .....	14
Floodplains .....	14
Wildfire Hazard .....	15
Environmental Constraints .....	16
Local Government Regulations .....	17
San Miguel County .....	17
San Juan County .....	18
Ouray County .....	19
Town of Rico .....	19
Montezuma County .....	20
Landscape-Based Conservation Priorities .....	20
Effects of Roads .....	20
Private Land Ownership .....	21
General Land Ownership Patterns .....	21
Conservation Challenges .....	22

Patented Mining Claims .....	22
Private Lands in Valley Bottoms .....	23
Dominant Private Lands with Limited Public Holdings .....	23
Role in Conservation Prioritization Process .....	23
Demographics .....	24
Overall Conservation Priorities .....	25
<b>WEB SITE .....</b>	<b>27</b>
<b>DIGITAL VIDEO .....</b>	<b>28</b>
<b>RELEVANT DOCUMENTS / REFERENCES .....</b>	<b>28</b>

## FIGURES

Study area .....	1
Areas of interest defined by each partner .....	2
Watersheds in the study area .....	3
Percentage of public lands as a function of elevation .....	4
Conservation Priorities Process .....	6
Disturbed Area Multiplier vs Slope .....	13
Prioritization process for calculating the landscape- based conservation priorities map .....	20
Landscape fragmentation due to roads .....	21
Mining claim pattern on Red Mountain Pass .....	22
Interactive web mapping site .....	27

## TABLES

Parameters used for the Viewshed and Skyline Analyses .....	9
Run-off coefficients used for each land cover type in calculating watershed health .....	10
Percent of population change between 1990 and 2000 .....	24
Percent of homes classified as 2nd homes in 2000 .....	24

## EXECUTIVE SUMMARY

The San Juan Skyway Spatial Analysis and Mapping Project evaluated the conservation value and development potential of relevant lands near the All American San Juan Skyway in southwestern Colorado. The project utilized a methodology that combined these quantities (conservation value and development potential) to rank or prioritize parcels for land conservation purposes. In addition to the analytical GIS effort, a digital video highlighting important aspects of the project was produced and a web site / web mapping services portal was established. A digital map atlas depicting important spatial themes and a GIS data distribution CD-ROM (containing GIS coverages and associated metadata) augment this report.

This work represents the first phase of the Colorado Department of Local Affairs (DOLA) San Juan Skyway Heritage Initiative. The results of this project will serve as a spatial foundation for the next phase efforts involving targeted conservation planning, increasing landowner awareness of land conservation alternatives and generating donor interest in strategic land preservation. Additionally, the project results will prove useful for pursuing future funding opportunities and land conservation initiatives beyond the scope of this grant.



## INTRODUCTION

To receive an All-American Road designation, a road must possess multiple intrinsic qualities that are nationally significant and contain one-of-a-kind features that do not exist elsewhere. The road or highway must also be considered a 'destination unto itself.' That is, the road must provide an exceptional traveling experience so recognized by travelers that they would make a drive along the highway a primary reason for their trip.

- National Scenic Byways Program web site

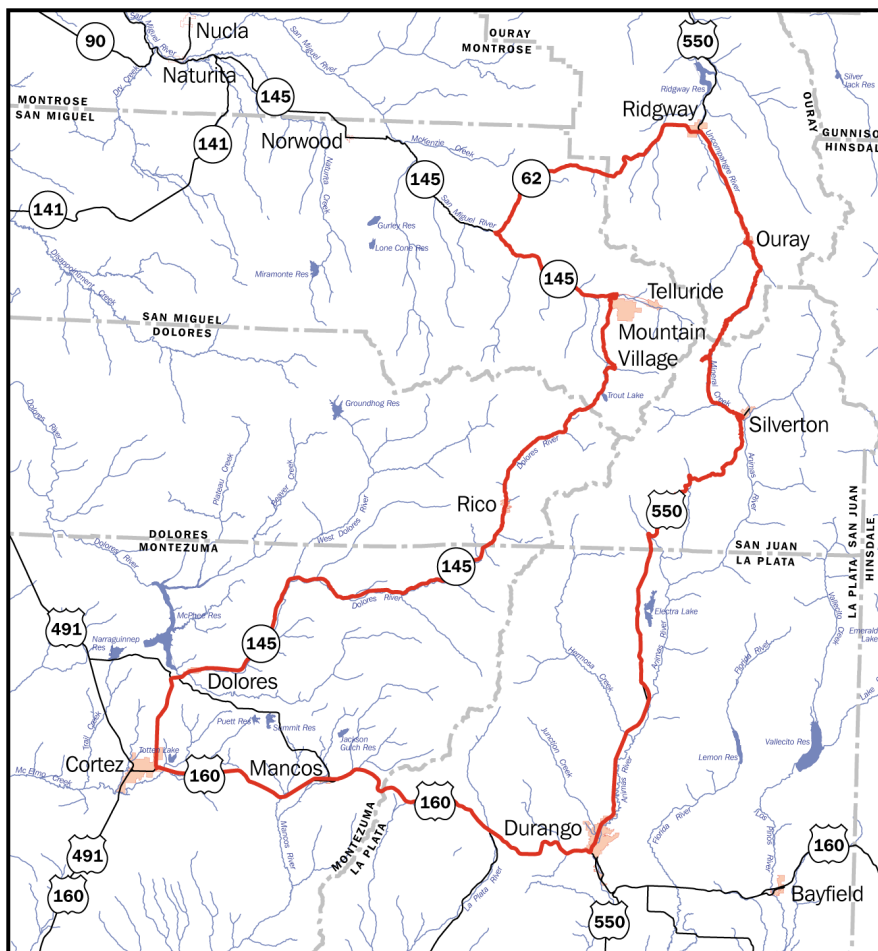


Figure 1.  
The red line delineates the San Juan Skyway, which traverses six southwest Colorado counties.

The world-renown San Juan Skyway traverses some 232 miles of rugged southwestern Colorado landscape (figure 1). Along its course the Skyway passes through six counties, numerous municipalities and runs through or near public lands administered by the U.S. Forest Service, the Bureau of Land Management, the National Park Service and the State of Colorado. The Skyway was the first byway within Colorado to receive both National Forest Scenic Byway and Colorado Scenic and Historic Byway designations. Its outstanding natural and historical qualities have made it one of only 22 designated All-American Roads (the "best of the best" among scenic and historic byways).

The Skyway's spectacular setting makes it a magnet for sight-seers, recreation enthusiasts, history and pre-history buffs. This natural and cultural magnificence has become one of the area's greatest economic assets, with many local economies heavily dependent upon Skyway visitors.

The top of the world setting (the San Juan Mountains contain 12 of Colorado's 14,000+ foot peaks) gives the traveler the impression that the Skyway and surroundings are protected public lands. In fact, over 50% of the land within one mile of the roadway is privately owned. The ultimate disposition of these private lands could profoundly change the Skyway experience, with potentially serious repercussions for tourism-dependent communities.

## Purpose and Goals

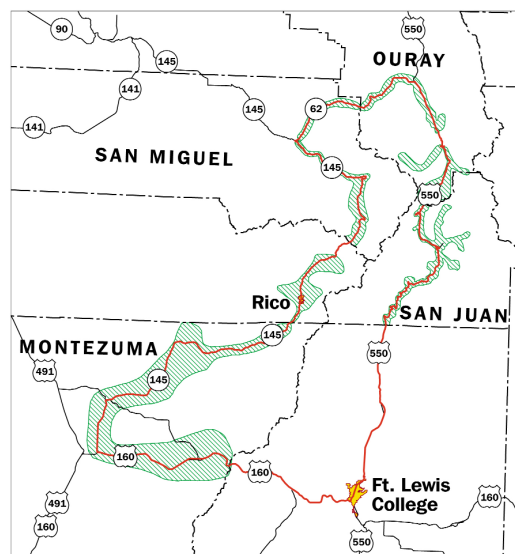
Colorado will have a better map than any other State in the Union, and the work will be of such a character that it will never need to be done again. Colorado will never support so dense a population that a more detailed survey will be required.

Dr. Ferdinand V. Hayden  
1875 Annual Report for the Hayden Survey

The San Juan Skyway Spatial Analysis and Mapping project is a cooperative effort among the counties of San Juan, Ouray, San Miguel and Montezuma, the Town of Rico, and the Office of Community Services at Fort Lewis College (Durango, CO). This project focuses on select segments of private lands along the Skyway corridor that have been identified by the participating partners as having high conservation values and the potential of being developed. Each participating partner defined an area of interest that included some or all of the Skyway corridor within or adjacent to their jurisdictional boundaries (figure 2). The resulting mapping and analyses will:

1. Create a spatial foundation to aid future projects in the corridor;
2. Serve as a prioritization tool for evaluating the conservation potential of individual private parcels;
3. Provide the necessary framework for pursuing future funding opportunities.

Figure 2. Areas of interest (green hatch) defined by each participating partner.



The San Juan Mountains are often referred to as the Switzerland of America and offer an unparalleled outdoor experience. The maps, words and images of this project are a poor substitute for the real thing. We can't experience the sights, sounds, smells, and feelings that this region offers. The on-the-ground scale of landforms, sense of magnificence and stunning diversity of landscape cannot be conveyed by words or images. But maps and images have their uses. We can "see" aspects of an area that are hidden. New themes can be derived by combining maps or applying mathematical rules to the terrain. The diversity of the Skyway can be viewed and analyzed as an entire entity, or pulled apart into discrete pieces. The digital landscape offers different views and insights, as well as its own form of terra incognita. This report and associated atlas traverse the Skyway's digital landscape. Hope you enjoy the ride!

## The San Juan Skyway – Its Resources and Threats

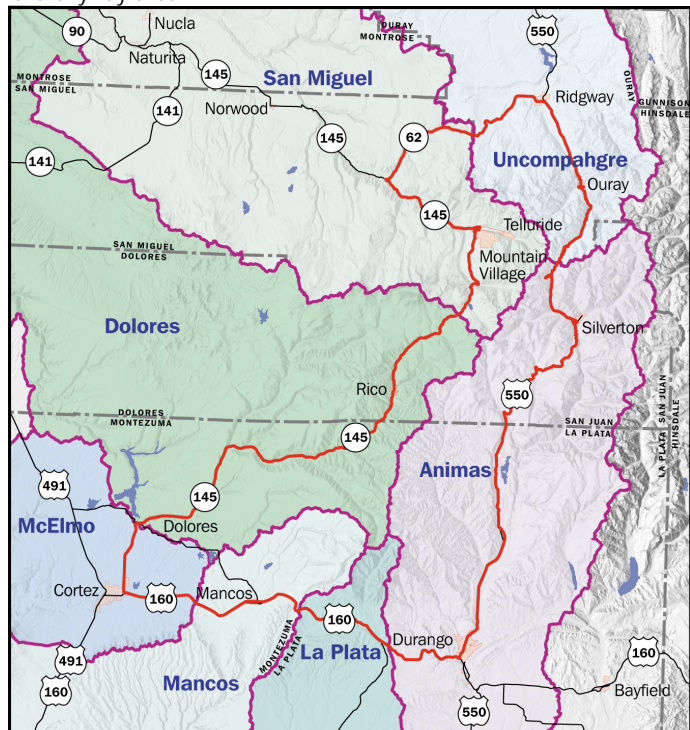
For if one link in nature's chain might be lost, another might be lost, until the whole of things vanish by piecemeal.

- Thomas Jefferson

### Physical Setting

The San Juan Skyway takes the visitor through the heart of the western San Juan Mountains. Seven significant drainage basins have their sources in the Skyway area (figure 3). The Uncompahgre River flows north from the Red Mountain Pass area, through Ridgway Reservoir in Ridgway State Park to its confluence with the Gunnison River in Delta. The San Miguel River flows west and northwest to its confluence with the Dolores River near Uravan. The Dolores River flows southwest through the Skyway area before taking an abrupt turn to the northwest at the town of Dolores. It proceeds northwest through McPhee Reservoir to its confluence with the Colorado River in the canyon country of Utah. McElmo Creek runs west to its confluence with the San Juan River near Aneth, Utah. The Mancos River runs south and west to its confluence with the San Juan River in New Mexico near the

Figure 3. Seven significant drainage basins have their sources in the Skyway area.





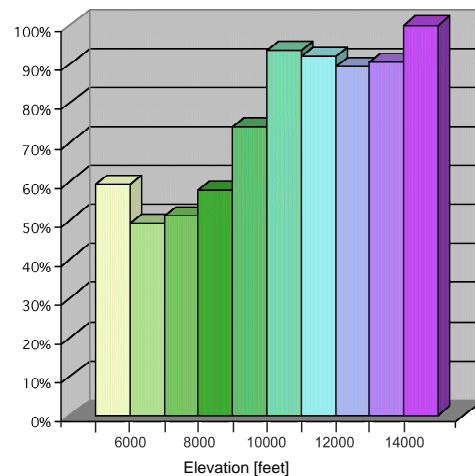
Box Canyon area, Ouray, Colorado

Four Corners Monument. The La Plata River flows south to its confluence with the San Juan River just west of Farmington, New Mexico. The Animas River flows south through Durango to its confluence with the San Juan River in Farmington, New Mexico.

These rivers have carved the rugged canyons, eroded and deposited much of the area's mineral riches, and made possible the human settlement of the region. Rivers and lakes are often referred to as the land's circulatory system and reflect the health of the watersheds in which they occur. Healthy watersheds provide clean water to downstream communities and agricultural operations, offer superior habitat for wildlife, enhance recreational opportunities and contribute to the aesthetic and visual appeal of an area.

The headwaters of these major watersheds are typically protected public lands (notable exceptions include high altitude mining claims in the Red Mountain Pass, Ophir and Rico areas). Lower elevation areas, including large tracts in agricultural use, generally have a much lower protected status. Figure 4 shows the percentage of land under public ownership as a function of elevation for the study area (the study area is shown in figure 1). Although uses on public lands can have significant downstream impacts, this project's focus deals with impacts from private lands.

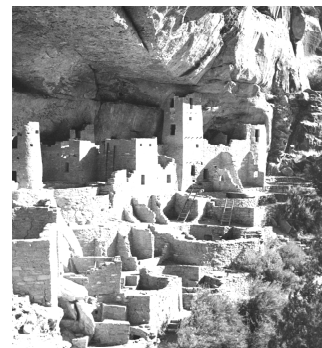
Figure 4. Percentage of public lands as a function of elevation.



## Pre-European Setting

There were people in the landscape long before there were public lands on which to recreate. The Colorado Historical Society lists archaeological sites with artifacts dating back to Early Archaic time – 7000 to 10,000 years ago. These early residents lived a nomadic lifestyle, hunting and gathering and moving with the seasonal changes.

The Ancestral Pueblo people – the Anasazis – left a stunning legacy of their occupation of the region in locales such as Mesa Verde and nearby Hovenweep. They were the region's first permanent residents, pursuing an agrarian way of life.



Anasazi ruins at Mesa Verde. Western History/Genealogy Department, Denver Public Library.

Perhaps 800 to 1000 years ago the modern Native American inhabitants, the Utes, moved into the area. Their territory included a vast portion of Colorado, Utah, Arizona and New Mexico, including the entire San Juan region. The current Southern Ute and Ute Mountain Ute Indian Reservations lie in the southernmost portion of the study area. The San Juan Skyway follows the pathways of these original inhabitants.

## Historical Context

In August 2002, a Red Mountain Pass landowner began tearing down historic structures that had been built over a hundred years earlier, an act symbolic of changes that are sweeping through the western U.S. Although the landowner claimed the structures were a liability, many felt that these structures formed a vital link to the past mining heritage of the region, and that this act, together with the "for sale" signs on the property, were a form of blackmail to set a higher than market rate price.

These structures and the many mines and prospects in the area were the work of miners. To these miners, the landscape meant hard dangerous work, but also meant the dream of riches. The latter part of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century saw vigorous mining activity in the area and turned this dream into reality for many prospectors. While the economics of hard rock mining have always produced boom and bust cycles, the current downturn looks to be permanent. The close of the Sunnyside mine in the early 1990s also marked the end of the hard rock mining era in the area.



Mining structure near Silverton, Colorado.

Today, mineral speculation has been replaced by real estate speculation. The landscape that once represented demanding labor, represents outdoor pleasure to today's prospective buyers. The utilitarian buildings of yesteryear are replaced by second homes and vacation cabins. A new struggle has emerged between private property rights proponents, who feel that landowners have unquestionable rights to do as they feel with their properties, and community rights proponents, who feel that these owners have obligations to their neighbors and their communities. The tie to the past, however, remains the dream of riches.



Land "For Sale" near Red Mountain Pass.

## PROJECT METHODOLOGY

There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact.

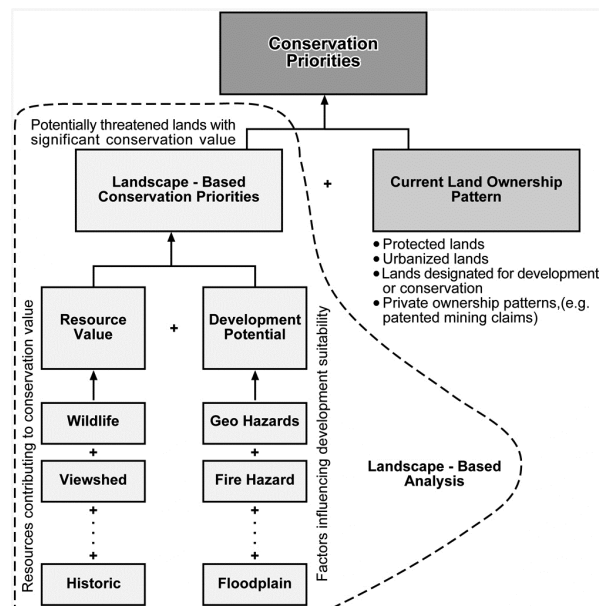
Mark Twain

Figure 5 – Conservation Priorities Process – provides a conceptual view of the project. The “Landscape-Based Conservation Priorities” section of the diagram illustrates two vital components, which are shown in the “Resource Value” (or conservation value) box and the “Development Potential” box. This section is referred to as landscape-based because it focuses predominantly on the naturally occurring systems – i.e., topographic, vegetative, geologic, etc parameters – largely separate from the human imposed land ownership pattern.

Resource value is the combination of spatial factors that contribute to the intrinsic conservation value of the area. These conservation resources include scenic vistas, agricultural resources, critical wildlife habitat, historic and archaeological resources, recreational amenities, areas important to water quality, and proximity to lands currently under public ownership.

Development potential combines factors that detract from or contribute to the “buildability” of a parcel, along with areas impacted by local government regulations. Building constraints include steep slopes, geologic hazards, avalanche hazard, proximity to existing roads (to access a property), floodplains, environmental constraints and wildfire hazard. Local government regulations impacting development potential include viewshed protection regulations, ridgeline development restrictions and wildlife habitat concerns.

Figure 5: Conservation Priorities Process



Resource value and development potential are combined to form the landscape-based conservation priorities. These are areas of the landscape with high conservation value that are likely to be developed based upon building constraints and local government regulations. Note that at this point, development potential has not been restricted to private parcels.

The results of the landscape-based analysis are then combined with the private land ownership pattern to define the overall conservation priorities.

There are advantages to decoupling the landscape-based computations from the human imposed land ownership pattern. For one, the digital representation of a parcel's location may involve considerable uncertainties. If this digital representation "shifts" due to a more accurate set of locational parameters, the parcel's value and priority status can be easily recalculated.

Another advantage allows public agencies to assess the conservation priority of any potential trade parcel that is currently in public ownership. If only private parcels are evaluated, then a separate analytical exercise would need to occur to similarly assess the conservation value of a potential publicly-owned trade parcel.

## Conservation Resources

Conservation is managing our natural resources, from the largest watershed, to the smallest ecosystem.

Essex Region Conservation Authority

Conservation resources are those factors that combine to make an area "valuable" from a conservation standpoint. Seven resources have been identified and utilized in this project. The composite of these seven resources is illustrated in map C8 in the digital atlas.

## Agricultural Resources

Eating is an agricultural act.

Wendell Berry

Map C1 in the accompanying digital map atlas shows the distribution of agricultural lands along the Skyway. Important areas in agricultural use include the northernmost area around Ridgway, the Animas Valley north of Durango, and virtually the entire stretch of the Skyway within Montezuma County.



Agricultural land near Mancos, Colorado.

Agricultural resources add to the open feel of the route, provide outstanding scenery, often contain significant wildlife habitat and help to define the gateways to a number of Skyway communities. These large tracts of private land are also important for their potential to significantly change the Skyway experience if developed.

The agricultural lands map combined irrigated lands identified by the American Farmland Trust for Ouray County, agriculturally-zoned properties and parcels identified with an agricultural land use code in Montezuma County, and agricultural categories (numbers 81 - 85) from the USGS/EPA National Land Cover Database (NLCD). See the associated metadata file for a detailed description.

## Recreational Resources

[T]here are many untrodden peaks, and, I will venture to say, many an interesting rock scramble, while if any member of the [Alpine] club wishes to cover himself with glory, let him climb, if he can, the Lizard's Head.

Percy Thomas, 1890

Outdoor recreation is a huge draw to the Skyway area. The recreational resources considered in our analysis include roads, trails, campgrounds and huts. These recreational amenities are illustrated in atlas map C2. For specifics on this data coverage, see the associated metadata file.

Recreational activities in the area are numerous and include hiking, biking (both touring and mountain biking), both "on-highway" and off-highway motorized use, mountaineering, rock climbing, skiing, snowshoeing, snowmobiling, camping, horseback riding, fishing, rafting and kayaking. The vast majority of recreational activities occur on the public lands along the Skyway. Access to a number of large tracts of public land with recreation potential is limited due to intervening private lands.



Horseback riders in San Juan country. Photo courtesy of Ken Francis.

## Visual Resources

In every landscape, the point of astonishment is the meeting of the sky and earth...

Ralph Waldo Emerson

The San Juan Skyway near Cortez, Colorado.



The San Juan Skyway is well known for its sweeping uninterrupted vistas. Visually conspicuous development in significant viewsheds or visually important ridgeline areas could drastically change the scenic experience and rural character.

The visual resource mapping combined two separate analyses: important viewsheds and visually significant skyline regions. Table 1 lists the parameters used for each analysis; digital atlas map C3 shows the combined visual resource map. The viewshed algorithm assesses the visibility of a structure on the landscape disregarding trees, intervening buildings and other non-topographic obstructions. The skyline utility checks for visibility of a structure above the physical skyline.

Table 1. Parameters used for the Viewshed and Skyline Analyses.

Parameters	Viewshed	Skyline
Viewer height	6 feet	6 feet
Point spacing along roadways	1/8 mile	1/8 mile
Look-to elevation (ground or structure)	35 ft.	35 ft.
Analysis cut-off (maximum distance from viewer)	6 miles	6 miles
Minimum angle, from horizontal, for "skyline"	NA	1°

## Ecological Resources (Wildlife Habitat)

Without habitat, there is no wildlife.

Wildlife Habitat Canada

The study area encompasses terrain with over a mile and a half of vertical relief. This vast elevation range results in a spectrum of ecosystems representative of those found from Alaska to northern Mexico. This ecosystem diversity results in abundant wildlife, including several economic species (such as elk, mule deer and bighorn sheep) along with threatened and endangered (T&E) species and species of special concern (such as bald eagle, osprey and lynx).

The computer analysis utilized the Colorado Division of Wildlife (CDOW)-sponsored Natural Diversity Information System (NDIS) data, the Colorado Natural Heritage Program (CNHP) potential conservation areas, State designated natural areas and The Nature Conservancy (TNC) portfolio areas to delineate important ecological resources. The associated metadata describe the data layers used and the resulting analysis in detail. Map C4 of the digital atlas shows the ecological resource distribution.

Elk herd near Durango, Colorado. Ken Francis.



## Watershed Health (Erosion Hazard)

He thinks of the Indian legends about the waters of the Rockies. He calls back one of the thousands of the springs they told about – a tiny spring that seeps out of the ground in a cool, mossy place, trickles over the stones to a ledge, and then throws itself into the air, falling, glittering, arching in a fine spray through space until it splashes into a small, clear pool. The Indian poets say that these waters have magical powers. They claim solemnly that once a man drinks of such waters, he must someday return to drink again.

Winfred Blevins  
"Old Jim Bridger Thinks Back"  
Give Your Heart to the Hawks

Watersheds in the Skyway region provide source water for numerous downstream communities. Healthy watersheds result in healthier ecosystems and higher water quality for drinking water, recreation and agricultural operations.

Excessive erosion in headwaters regions can remove vegetation and produce significantly greater downstream sedimentation. For this reason, we used an erosion hazard estimate to highlight areas where disturbance could impact watershed health. Erosion hazard was computed as the product of the slope gradient and a runoff coefficient estimated from land cover type. The land cover type was obtained from the NLCD referred to in the Agricultural Resources section above. Table 2 shows the coefficients used for each land cover type. Map C5 shows the erosion hazard calculations results.



Waterfall near Eureka, Colorado.

Table 2. Run-off coefficients used for each land cover type in calculating watershed health.

Land Cover Type	Run-off Coefficient
Low Intensity Residential	0.5
High Intensity Residential	0.7
Commercial/Industrial/Transportation	0.8
Bare Rock/Sand/Clay	0.7
Quarries/Strip Mines/Gravel Pits	0.7
Transitional	0.5
Deciduous Forest	0.25
Evergreen Forest	0.25
Mixed Forest	0.25
Shrubland	0.25

Land Cover Type	Run-off Coefficient
Orchards/Vineyards/Other	0.25
Grasslands/Herbaceous	0.4
Pasture/Hay	0.6
Row Crops	0.6
Small Grains	0.6
Fallow	0.8
Urban/Recreational Grasses	0.25
Woody Wetlands	0.25
Emergent Herbaceous Wetlands	0.3

### Proximity to Public Land

Thousands of tired, nerve shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wildness is a necessity; and that mountain parks and reservations are useful not only as fountains of timber and irrigating rivers but as fountain of life.

John Muir (1898)

The San Juan Skyway passes through or near land administered by the San Juan and Uncompahgre National Forests, the BLM, National Park Service, State of Colorado, county and municipal open space, as well as local and national land trusts. The Weminuche Wilderness Area, the largest in the lower 48 states, lies in the east-central portion of the study area.

Properties that are adjacent to land already in public ownership can provide larger wildlife areas, additional recreational opportunities and other uses in the public interest. For this reason, these lands are often deemed to have higher conservation value.

For analytical purposes, buffers were run at distances of ~0.25 miles (400 meters) and ~0.50 miles (800 meters) from lands in public ownership. These results are shown in Map C6 of the digital atlas.

### Historical and Archaeological Resources

The cultural heritage along the San Juan Skyway is an irreplaceable treasure. Into it are woven centuries of human endeavor in a rugged and beautiful land, the San Juan Country.

Ken Francis, Office of Community Services, Fort Lewis College

The human story in the area is as compelling as the natural landscape. Native Americans were the first residents of the region and have left an enduring legacy. Mesa Verde National Park showcases incredible prehistoric architecture and construction of the Ancestral Pueblo people. The Ute Indians' traditional territory covered the entire San Juan region and the Skyway follows trails pioneered by the Utes. The Southern Ute Reservation covers the southern portion of the study area.

Hard rock mining dominates the more recent history of the region. After the discovery of gold, silver and other important metals, boom towns sprouted, seemingly overnight. Several of these remain today, including Silverton, Ouray, Rico and Telluride.



View of the Pandora Mill located three miles downhill from the Smuggler-Union mine in Pandora, San Miguel County, Colorado, 1900. Western History/Genealogy Department, Denver Public Library.

The archaeological and historical resources map was derived from information supplied by the Colorado Historical Society (CHS). Due to the sensitivity of many sites, the resolution of archaeological data was degraded to the section level (~ 1 square mile). Most historic sites were represented by UTM coordinates in the CHS database. Map C7 shows the resulting map combining historical and archaeological resources.

## Development Potential

A doctor can bury his mistakes, but an architect can only advise his clients to plant vines.

Frank Lloyd Wright

The second major component of the conservation analysis involves estimating the development potential of a location. Development potential is reduced by the presence of building constraints and by building regulations enacted by local governments. Please note that constraints and regulations serve to lower the development potential of a property, but, except in rare cases, do not preclude development. Typically, the presence of hazards or regulated resources requires additional planning and engineering work, which add to the cost and effort of developing a property.

House along the San Juan Skyway near Rico, Colorado.



## Development Constraints

Land use planning to reduce natural hazards is ultimately and fundamentally about promoting a more sustainable human settlement pattern and living more lightly and sensibly on the earth.

Timothy Bealley, Hazards Researcher

Development constraints are factors limiting the “buildability” of a location. Seven constraints, separate from any enacted regulations, were considered in the analysis. The composite of these seven constraints plus the individual local government regulations is illustrated in map D8 in the digital atlas.

## Steep Slopes

We keep trying to build where Nature says we shouldn’t build, and then when something like septic systems fail or structural damage due to slope overloading or mudslides happen, we wonder why.

Jeff Tittel, director of the Sierra Club in New Jersey

Construction on steep slopes increases the disturbed area for a building location vs an equivalent site on flat ground (figure 6). This increased disturbance opens more ground to erosion (and subsequent down slope sedimentation), invasive weeds and visual impacts.

Digital atlas map D1 shows the slope gradient distribution within the study area. Slope is also used in computing the watershed resources map (via the erosion hazard model) and is used in the wildfire hazard model described below.

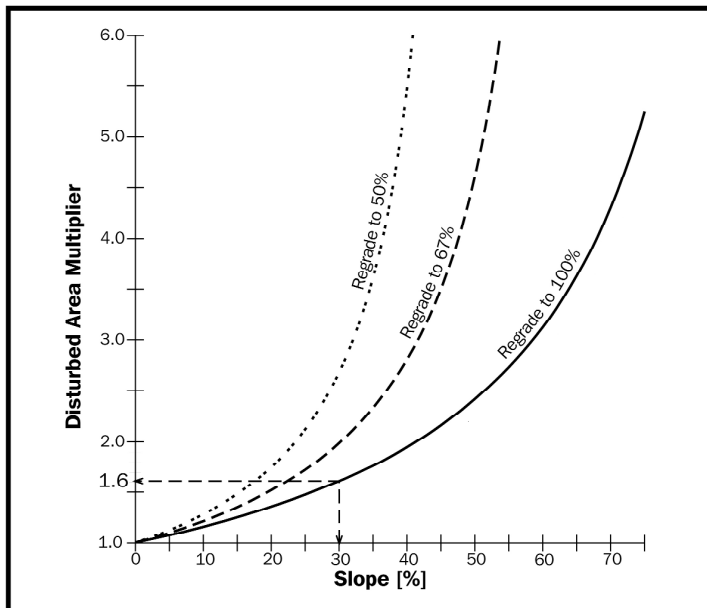


Figure 6. Construction on steep slopes increases the disturbed area for a building location vs an equivalent site on flat ground. This graph illustrates the relationship between slope and the area disturbed by construction for various regrading requirements.

For example, a site on a 30% slope, with cuts and fills regraded to a 100% slope, would disturb 1.6 times the area of a comparable site on flat ground.

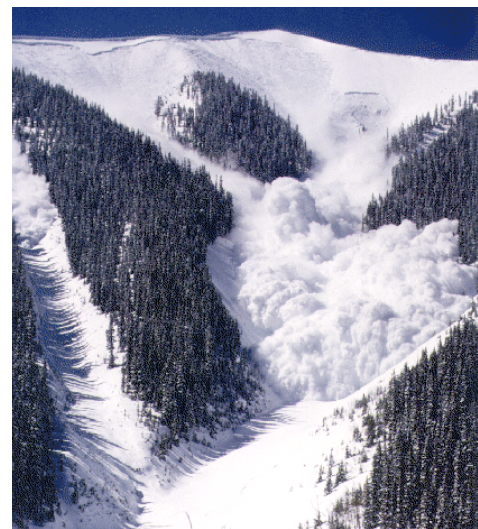
## Avalanche Hazard

The easiest way to rescue yourself from an avalanche is to not get into trouble in the first place.

[Avalanche.org](http://Avalanche.org)

One of the most serious dangers to life and property within the Skyway is the hazard presented by avalanches. The Mountain Studies Institute (Silverton) web site documents that there were 264 avalanche deaths in the area between 1874 and 1991.

A variety of data sources were combined to produce the avalanche hazard map (map D2 in the digital atlas), including mapping from the Colorado Geological Society and the Colorado Avalanche Information Center. See the metadata file for specifics.



Avalanche on Red Mountain Pass, 1987. This avalanche buried US 550 with 3 ft. x 800 ft. of snow. Tim Lane, Colorado Avalanche Information Center web site.

## Geologic Hazards

The evolution of the landscape is a balance between uplift and erosion over the course of time.

Frank Press and Raymond Siever, Earth 2<sup>nd</sup> Edition, 1974

The geologic hazard mapping combined information from a variety of data sources (see metadata for specifics). Where available, factors such as unstable slopes, rock fall zones, debris flow areas, etc were combined with a regional representation for the Mancos Shale – a swelling clay that often wreaks havoc with construction. Coverage for geologic hazards was incomplete and included much of San Miguel County and the areas around Rico, Dolores and Ouray. To compensate for the incompleteness of the datasets, we normalized the resulting development potential map based upon whether or not geologic hazards occurred within an area. Map D3 shows the hazards mapped along the San Juan Skyway.



Mudslide on the Million Dollar Highway heading into Ouray, Colorado, 2002.

## Proximity to Roads

If you build it, they will come.

Field of Dreams (1989)

Areas close to existing roadways generally have easier access and are deemed to have proportionately higher development potential than areas more distant from roadways. All public roads included in the Colorado Department of Transportation (CDOT) database (available from <http://www.dot.state.co.us>) were used in the computation. Buffers of ~ 0.25 miles (400 meters), ~ 0.5 miles (800 meters) and ~ 1 mile (1600 meters) around each roadway were created to estimate progressively more difficult access, (map D4 in the digital atlas).

We puzzled over whether to include private roads (as well as public roads) in this analysis. We chose not to for two reasons: (1) a land owner may not have access to a property through a private road and validating access would require a title search for easements; and (2) the condition of private roads in the USGS DLG database is quite variable and these roads may not provide practical access to a property.

## Floodplains

Since flooding and erosion are natural processes that are extremely difficult and costly to combat directly, the management and planning of floodplains is a reasonable alternative to ensure public safety and reduce the cost of damages.

The Green Lane™, Environment Canada's World Wide Web site

Floodplains are a vital part of a river ecosystem and play an important role in river and watershed health. They are major centers of biological diversity and act as water filters and flood buffers. Development in floodplains, however, can lead to property damage and, in extreme cases, loss of life.

Floodplains were digitized predominantly from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). The one exception was the area around Rico where more detailed mapping was performed by an engineering company. Map D5 shows the floodplain hazard map for the Skyway; the associated metadata file contains specifics.



Flood damage caused by the Dallas Creek flash flood in July 1999, Ouray County, Colorado. National Weather Service Staff.

### Wildfire Hazard

Fire connotes warmth and cheer and also fear and destruction. In nature, fire has the same ambivalence. It is both a destroyer and a regenerator of life.

Robert Leo Smith, *Elements of Ecology*, 3<sup>rd</sup> Addition (1992)

The danger and devastation of wildfire was brought home to the Skyway region when on June 9, 2002 the Missionary Ridge fire began north of Durango. On June 25, the Valley Fire began just to the west in the Animas Valley. Together, these fires burned over 70,000 acres and destroyed 56 homes. In addition, one firefighter was killed in the line of duty. The ongoing effects of the fire - increased runoff, erosion, sedimentation and mass wasting - will last for years. An excellent chronology of the fires is available on the San Juan National Forest web site:

Missionary Ridge fire north of Durango, 2002. La Plata County Office of Emergency Management web site



[http://www.fs.fed.us/r2/sanjuan/bulletin\\_board/MR.htm](http://www.fs.fed.us/r2/sanjuan/bulletin_board/MR.htm)

For this project we adapted a new wildfire model from elements of two existing models: the National Fire Protection Association's NFPA 299 rating system (used by the Colorado Office of Emergency Management) and the Idaho Panhandle National Forests Wildfire Hazard-Risk Assessment (see <http://jfsp.nifc.gov/conferenceproc/HR-04Harkinsetal.pdf>). We further modified the model to include an evaporation submodel. Our final wildfire hazard computation:

(precipitation submodel) x (evaporation submodel) x (slope gradient submodel) x (fuel hazard submodel) x (disturbance regime submodel), where:

The precipitation submodel came from the PRISM (Parameter-elevation Regression on Independent Slopes Model) modeling from Oregon State University's Spatial Climate Analysis Service (see <http://www.ocs.orst.edu/prism/>).

The evaporation submodel was computed as the product of the (normalized) average annual maximum temperature (from PRISM) and the annual relative solar incidence (including shadows) derived from the USGS National Elevation Database (NED).

The slope gradient submodel was computed from the USGS NED and represented as the quotient of the vertical rise over the horizontal run (% slope).

The fuel hazard submodel was reclassified from the USGS/EPA NLCD (see metadata for reclassification details).

The disturbance regime submodel was also reclassified from the NLCD (again see metadata for specifics).

The final wildfire hazard map is shown in map D6 of the digital atlas. We chose not to include built up areas (greater hazard to property) since many of the private parcels we're evaluating are unbuilt and distant from population centers.

### **Environmental Constraints**

Nationwide, over 20,000 km of rivers and streams and over 75,000 ha of lakes and reservoirs are adversely affected by contaminated water draining from abandoned mines.

Jeffrey G. Skousen, West Virginia University & George F. Vance, University of Wyoming

Environmental issues present concerns for health, safety and liability. With the hard rock mining history of the area, contamination of ground and surface water is a very real problem.

For this map, we combined the EPA's industrial facility discharge sites, permit compliance sites, superfund sites, toxic release inventory sites, Resource Conservation and Recovery Act (RCRA) solid and toxic waste sites, 303b streams and an inventory of mines, adits and tailings sites from the Colorado Geological Society. The environmental constraints map is shown in digital atlas map D7.



Stream pollution caused by historic mining in Cement Creek north of Silverton, Colorado.

## Local Government Regulations

Get the thing straight once and for all. The policeman isn't there to create disorder. The policeman is there to preserve disorder.

Richard Daley, Chicago mayor

Local governments may pass legislation that impacts the development potential of a site. As much as possible, we've tried to give the regulations a geographic expression. We did not, however, include a regulation in the analysis if:

- The regulation was included in the general development constraints already detailed.
- The regulation referred to site-specific issues.
- We were unable to infer a spatial representation from the description.
- The maps or files that were referenced by the regulation were not available from our local government contacts.
- The regulation did not appear to impact residential development potential.
- The level of detail specified was beyond the resolution used in this project.

The regulations outlined for the local governments below were incorporated into the overall development potential mapping (map D8 in the digital atlas).

### San Miguel County

The San Miguel County Land Use Code contains references to floodplain hazard, geologic hazard and wildfire areas that were addressed in the Development Constraint section. Factors analyzed in addition to these include:

Scenic Foreground Overlay (SFO) and Scenic View Plane (SVP) – Section 5-318. We obtained GIS files from the County approximating these overlay zones. We used these files to establish parameters for viewshed mapping to more resolutely identify these zones.

Wildlife Habitat Areas: Section 5-407 establishes land use standards for areas mapped within CDOW's Wildlife Resource Information System (WRIS) and areas mapped by CNHP. Areas specifically addressed and implemented in the GIS analysis are: Section 5-407 B. Deer, Elk and Bighorn Sheep Winter Concentration Area/Severe Winter Range; Section 5-407 C. Deer, Elk and Bighorn Sheep Winter Range; Section 5-407 D. Deer and Elk Migration Corridors; and Section 5-407 E. Deer and Elk Production Areas.



Lizard Head, on the San Miguel/Dolores County line, Colorado. National Weather Service Staff.

The eastern portion of San Miguel County lies in the Telluride R-1 School District. Residential construction in this District is subject to specific regulations, two of which we've included in our analysis.

5-2102 A. Ridgeline Development (in the Telluride R-1 School District): this paragraph specifies roadways and distances subject to skyline development restrictions. Critical skyline regions, where a 35-foot structure would break the skyline from the specified roadways within the specified distance zone, were mapped and included in the development potential calculation.

5-2102 B. Development Above or Near Treeline (in the Telluride R-1 School District): this regulation restricts development "above or within 200 vertical feet of treeline". Treeline, the approximate uppermost elevation at which upright trees exist, varies with factors such as aspect and exposure. To approximate this undulating line, we used the NLCD together with an elevation threshold of 11,500 feet. That is, we selected land cover categories that were pertinent for this zone (e.g., perennial ice/snow, bare rock/sand/clay, grasslands/herbaceous) together with areas where the elevation exceeded 11,500 feet. We then took N-S and E-W cross-sections to determine areas within 200 vertical feet of treeline. The resulting areas were included in the development potential analysis.

High Country Zoning: a special restrictive zone was adopted as a Land Use Code amendment (Resolution 2002-14). The outline of this zone was obtained from the San Miguel County web site (<http://www.sanmiguelcounty.org>) and included in the development potential analysis.

## **San Juan County**

The San Juan County Zoning and Land Use Regulations document has chapters addressing avalanche hazard, geologic hazards, floodplains and wildfire, which have been addressed in the Development Constraints section. In addition the Regulations define overlay districts for watershed protection, mineral resources and a Town/County (Silverton / San Juan) mutual interest zone. These are either difficult to quantify spatially or have limited impact on residential development.

The district that has been included in the analysis is the Scenic Preservation Overlay District (section 1-114). Section 1-114.1 states "The district includes all sites located within 1,500 feet of the centerline of U.S. Highway 550 and/or within 1,500 feet of



Silverton, San Juan County, Colorado.

the centerline of the track of the Durango and Silverton Narrow Gauge Railroad and within 1,500 feet of the Alpine Loop from Eureka townsite north to the county boundary." Those areas within the Skyway AOI were delineated, viewshed mapping was run and clipped to this 1500-ft buffer. The results were included in the overall development potential map.

### Ouray County

The Ouray County Land Use Code (online at <http://www.co.ouray.co.us>) outlines regulations related to flood hazard and geologic hazard areas that have been dealt with in the Development Constraints section. In addition, Wildlife Habitat Regulations are outlined in Section 13, but the maps referenced by this Section were not available from our local contact and were consequently not included. Section 11 of the Code references Mineral Resource Regulations. These regulations did not appear to limit residential development potential.

The Land Use Code outlines Visual Impact Regulations (Section 9) that have been addressed specifically. In particular, Section 9.3 states "All structures at or within 1.5 miles of the centerline of the roads or highways listed under Section 9.3 A. (as represented by the Ouray County Visual Impact Corridor Map) shall be subject to the following point system." It then goes on to detail a system that assigns points based upon parcel configuration (size, if in subdivision or PUD) or proposed structure or landscape design (size, height, color, additional screening), along with the amount of natural screening. We used viewshed mapping from the designated roadways ("U.S. Highway 550, Colorado Highway 62, that portion of County Road 1 lying between County Road 24 and the south intersection of County Road 1A and County Road 1, and County Roads 5, 7, 8, 10, 24 and 24A") to estimate the amount of topographic screening within the 1.5-mile zone.



Theater. Ouray, Colorado. 1903. Western History/ Genealogy Department, Denver Public Library

The Land Use Code also addresses skyline development in Section 9.3 C.: "No structure shall break the skyline as seen from any viewing point within any viewing window as established by Section 9.6 D. of this Code except...". The Code details two exceptions that are beyond the resolution of our elevation data and consequently were not addressed. The viewing window referenced in Section 9.6 D. includes all portions of the roads referenced in the previous paragraph that fall within 1.5 miles of the structure. To approximate the conditions of this Section, we mapped areas where a 35-foot structure (specified in the Land Use Code) would be visible above the physical skyline. The skyline and viewshed mapping were included in the resulting development potential mapping.

### Town of Rico

The Town of Rico Land Use Code addresses issues such as avalanche hazards, geologic hazards, wildfire hazard and floodplains, which have been dealt with in the Development Constraints section. The Water Protection Overlay District (Article 455.6) describes a spatial configuration that is too fine-scale for this analysis (25

Town of Rico, Dolores County, Colorado.



foot inner and 100 foot outer buffers). The Wildlife Habitat Areas (Article 455.4) does not place significant restrictions on development and was not included in the analysis.

The Town did have detailed mapping for the immediate area around Rico and this was incorporated into the GIS analysis.

## Montezuma County

The Montezuma County Land Use Code establishes Threshold Standards that address issues such as wildfire hazard, floodplains and geologic hazards, which were included in the Development Constraints section. The High Impact Commercial and Industrial Permitting Chapter of the Land Use Code (Chapter 3) addresses an operation that “(a) changes the basic character or the use of the environment in which the construction, activity, or operation occurs, (b) exceeds the Threshold Standards of these regulations...”. The site-specific nature of the requirements of this Chapter make regional delineation of potentially impacted areas difficult. The Landowner- Initiated Zoning established in Chapter 3 was utilized to help delineate lands in agricultural use mentioned in the Agricultural Resources section of this report.

Dolores, Colorado, in Montezuma County. 1920 - 1930.  
Western History/ Genealogy Department, Denver Public Library.



## Landscape-Based Conservation Priorities

I entrust myself to earth,  
Earth entrusts herself to me.

Thich Nhat Hanh

The conservation resource value and development potential computations are combined to create the landscape-based conservation priorities (see figure 5). Figure 7 graphically illustrates this prioritization process. Lands that are high in both parameters are deemed worthy of protection based upon their intrinsic conservation values and are likely to be developed based upon physical characteristics. At this point in the process, we have not yet considered the land ownership pattern. Map L1 shows the analytical results.

Figure 7. Prioritization process for calculating the landscape-based conservation priorities map

Development Potential	H	L	M	H
	M	L	M	H
	L	L	L	M
	L	M	H	
Conservation Values				

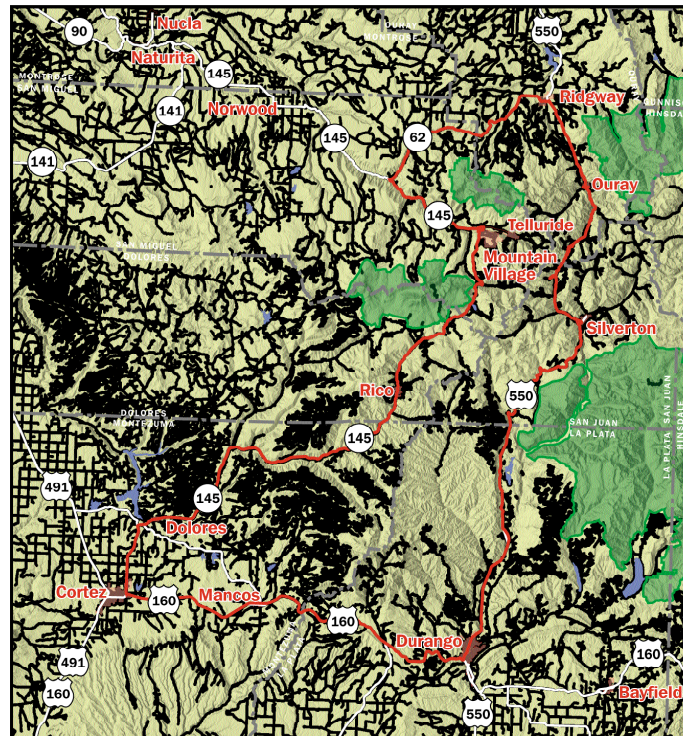
## Effects of Roads

Roads may be overemphasized as a positive factor in the conservation priorities analysis. Public roads are considered a recreational amenity for the access they provide and for their sightseeing recreational use. Also, visual resource calculations were performed from the Skyway and are thus proximal to this roadway. Consequently roads add to conservation resource value.

In addition, roads add to development potential through the proximity analysis. Since the conservation priorities are based upon the combination of resource value and development potential, roads are positively weighted in each, producing a higher priority value.

From an ecological standpoint, roads are typically considered to be a negative factor by fragmenting habitat, increasing runoff and facilitating the spread of exotic weeds. It may be worth including a theme such as fragmentation (see figure 8) as a conservation resource value to emphasize the ecological value of unroaded areas.

Figure 8. Landscape fragmentation due to roads. The US Forest Service suggest that wildlife movement and activities are altered up to 250 meters from roads. This map illustrates the remaining land fragments after generating a 250 meters buffer off the USGS 1:100,000 scale DLG roads. The larger undissected areas in green are wilderness areas.



## Private Land Ownership

Private parcels create a checkerboard of ownerships each with their own system of management (including no management at all). The decisions made on individual parcels can have a major effect on regional forest management if considered collectively.

North Quabbin Woods, New England Forestry Foundation

## General Land Ownership Patterns

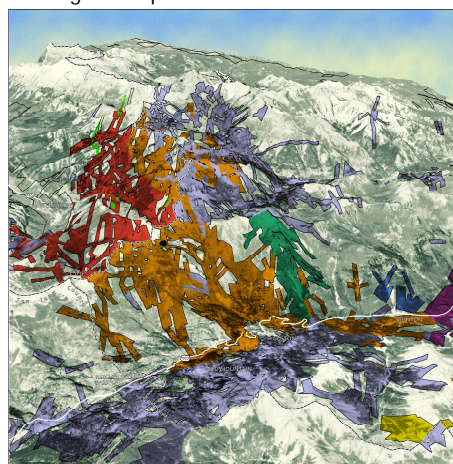
As mentioned earlier, over 50% of the land within one mile of the Skyway is privately owned. The private land ownership pattern is largely a function of the local land use and has significant ramifications for conservation efforts.

The Ridgway to Placerville corridor, the Dolores to Durango corridor (passing through Cortez and Mancos along the way) and the mesas above the San Miguel River along Highway 145 (e.g., Wilson Mesa, Specie Mesa, and Deep Creek Mesa) are dominated by private lands with limited public land holdings. Many of the large tracts are in agricultural use; several municipalities and rural subdivisions are also located in these areas. The private / public land ownership configuration shows little relationship to local topography.

The segments along the Upper Animas River in La Plata County and the Upper Dolores River (above Dolores) in Montezuma County are dominated by private lands in the valley bottoms with public lands along much of the hillsides and ridgetops. As above, many of the large tracts are in agricultural use.

The corridors around Rico, Ophir and the Red Mountain Pass area (Ouray, Silverton and Telluride) are dominated by the jumbled patented mining claim pattern (figure 9). Originally intended to follow trends of mineral bearing rocks, these mining claims present a mind-boggling array of overlapping ownerships.

Figure 9. 3D view of Red Mountain Pass mining claim pattern.



To summarize, (1) the northernmost and southernmost portions of the Skyway are dominated by private lands with limited public land holdings. (2) The upper Dolores River Valley in Montezuma County and the Upper Animas Valley in La Plata County show a pattern common in many Colorado mountain valleys – private lands in the valley bottoms, with public lands on most hillsides and ridgetops. (3) The private lands around Red Mountain Pass, Rico and Ophir are predominantly in the form of patented mining claims.

### **Conservation Challenges**

Each of these land ownership patterns presents its own conservation challenges. The San Juan Skyway Strategic Framework Plan (see References) presents an excellent discussion of open land protection approaches and techniques. The Plan emphasizes that along with the physical private land ownership pattern, which is the focus in this section, there are significant social, cultural and political differences that vary geographically along the Skyway. The discussion that follows concentrates on the tactics most appropriate for the physical ownership pattern.

### **Patented Mining Claims**

Since patented mining claims in the region virtually always occur as private inholdings in a matrix of federally-managed public lands, the most appropriate tactics are those that return the claims to ownership by the managing agency (either the USFS or BLM).

These would include (i) land exchanges, where claims deemed important for conservation purposes are exchanged for less sensitive lands currently in public ownership (typically near municipalities or rural subdivisions), and (ii) full title purchases by local or national land trusts, which are ultimately conveyed to the managing agency.

### **Private Lands in Valley Bottoms**

Many of the private properties in valley bottom areas are active agricultural lands, which contribute to the rural character of the Skyway. In addition, these properties contribute economically to their communities and provide local sources for agricultural products. For all these reasons, maintaining the agricultural use of these properties serves the conservation objectives for the region. Conservation easements, obtained through purchase, transfer or donation of development rights, are the preferred conservation tools in this situation.

Other properties in valley bottoms are smaller lots in rural subdivisions or in rural residential use. Deed restrictions and covenants through local property owner's associations, can be important tools for open land protection.

### **Dominant Private Lands with Limited Public Holdings**

The areas where private lands dominate tend to have the largest diversity in private land use and consequently require all the tools in conservation toolbox. For agricultural properties, conservation easements or limited development scenarios are preferred. Deed restrictions and covenants play their roles in appropriate locales. Land exchanges may be preferred for properties that are adjacent to public lands. Certain outstanding properties may be targeting for full title purchases. If the political climate is conducive, land use regulations may be appropriate for protecting certain lands, particularly in visually conspicuous areas.

### **Role in Conservation Prioritization Process**

The landscape-based conservation prioritization process rates locations without regard to land status. This has advantages over performing the assessment only within private lands. For one, digital representations of some parcels may contain considerable spatial uncertainties. If the parcel location changes to a more accurate configuration, then the priority analysis has already been completed for the new location.

A second advantage relates to the conservation value of potential exchange parcels that are currently within public ownership. The relative conservation values of the (currently) private parcel and the (currently) public parcel can be easily compared without recomputation.

To establish overall conservation priorities, the public lands are "masked" out, allowing the evaluation of properties currently in private ownership.

## Demographics

The greatest shortcoming of the human race is our inability to understand the exponential function.

Dr. Albert A. Bartlett, Emeritus Professor of Physics, University of Colorado;  
World Population Balance Board of Advisors

The decade of the 1990s was an era of rapid growth in Colorado. According to the Census Bureau, Colorado ranked third in the nation in population growth with a population change exceeding 30%. The Skyway area grew at an even greater rate with the population change over the decade in the study area topping 35%, with many areas growing faster still. The Colorado Department of Local Affairs expects robust growth to continue for the foreseeable future with total population for the area expected to increase over 75% by 2030.

Table 3 shows the population change between 1990 and 2000 for the six San Juan Skyway counties. The interesting anomaly is San Juan County, which lost 25% of its population during the decade. The economy of the County was closely tied to hard rock mining. The closure of the Sunnyside Mine in 1992 resulted in the loss of many jobs and, ultimately, population. The economic transition from mining to other industries (particularly tourism) is well under way, however, and County population has grown in the first years of the new decade.

Table 3. Percent of population change between 1990 and 2000.

County	Population Change 1990-2000
Dolores	22.6%
La Plata	36.1%
Montezuma	27.6%
Ouray	63.1%
San Juan	-25.1%
San Miguel	80.5%

The “vacation paradise” reputation of the region is well deserved and reflected in the number of seasonal homes in the area (see table 4). While most of the Skyway’s resort communities have made a reasonable effort to plan for this type of growth, some backcountry trends have disturbing implications for land conservation. Vacation cabins and second homes, often in highcountry areas lacking infrastructure and ill-suited for growth, are being promoted in venues such as Ebay – the popular internet-based auction site. Fortunately, a variety of conservation efforts seem to be making headway in many of the most sensitive locales.

Table 4. Percent of homes classified as 2nd homes in the 2000 census.

County	Percent of Homes Classified as 2nd Homes
Dolores	24.1%
La Plata	11.8%
Montezuma	4.6%
Ouray	12.7%
San Juan	49.4%
San Miguel	33.5%

## Overall Conservation Priorities

The Chinese use two brush strokes to write the word 'crisis.' One brush stroke stands for danger; the other for opportunity. In a crisis, be aware of the danger - but recognize the opportunity.

Richard M. Nixon

The conservation priorities process assigns the highest priority to those lands associated with the greatest conservation value and the highest development potential (map L1 in the digital atlas).

The conservation value (sometimes called resource value) is determined by assessing the occurrence of desirable natural and cultural attributes, such as scenic vistas, critical wildlife habitat, historical resources and important agricultural lands. The development potential is estimated by considering factors that contribute to or detract from the "buildability" of an area - factors such as steep slopes, geologic hazards, avalanche hazard and proximity to access roads (both processes are detailed in earlier sections). Together, these quantities - conservation value and development potential - combine to form what we call "landscape-based conservation priorities." The term "landscape-based" is used to indicate that this calculation is derived from natural and cultural features, separate from the often complex private land ownership pattern.

Since our conservation efforts are focused on private lands, the land ownership pattern is a vitally important consideration. The most critical Skyway properties, from a land conservation perspective, fall into two prominent categories.

Agricultural lands dominate the northernmost and southernmost portions of the Skyway, along with valley bottom areas in portions of the Animas and Dolores River drainages. Virtually all Skyway communities consider lands in agricultural use to contribute economically, ecologically and culturally to the region's high quality of life.

Consequently, voluntary conservation easements, restricting residential and commercial development in favor of perpetual agricultural use, are the preferred mechanism for land conservation in these areas.

A second prominent land ownership pattern, and one that is particularly vexing from a conservation standpoint, is that associated with patented mining claims. Originally intended to follow trends of mineral-bearing rocks, these mining claims present a mind-boggling array of overlapping ownerships.

Skyway communities embrace the hard rock mining heritage that was the region's economic cornerstone for many years. But the 19th century land patenting process - a process in which private parcels are literally carved from public land - has led to unintended 21st century consequences.

Environmental issues associated with some abandoned mines have led to downstream water quality problems along with significant liability and cleanup concerns. Many public trails and even trailhead parking areas have inadvertently been located on private land, opening the door to potential conflict between public land users and private land owners. And finally, the rise of second homes and vacation cabins, in areas ill-suited for residential development, present communities with the very real possibility of backcountry sprawl.

Since these patented mining claims are on lands that originally belonged to the American public, the preferred conservation technique is one that returns these lands to the public domain. Typically, this is accomplished either through full title purchase of claims, which are subsequently conveyed to the managing agency of the surrounding public land (usually the Forest Service or BLM). Another appropriate method is through land exchanges, where public land in less sensitive locations is swapped for high conservation priority parcels.

Ultimately, the local private land ownership pattern is combined with the landscape-based conservation priorities to form the overall conservation priorities. Priority parcels are then grouped into acquisition scenarios based upon urgency and funding availability. These acquisition scenarios, and the analytical framework on which they're built, form a solid foundation to increase funder awareness of the region's resources and to generate landowner interest in land conservation possibilities.

In an ever more competitive funding environment, the San Juan Skyway Spatial Analysis and Mapping Project demonstrates the commitment of Skyway communities toward preserving their unparalleled historical and natural environment and the resulting high quality of life.

## WEB SITE

Plans and maps represent a static view or snapshot of a process. In reality, a host of different scenarios can be followed to different ends. An interactive web mapping site was developed to enable users to explore a spectrum of options and develop conservation scenarios that fit within available resources (<http://www.sanjuanskyway.net>).

Figure 10 shows a screen shot from the interactive mapping site. In this example, a subset of properties, shown in yellow have been selected. These properties, along with other parcels in the area (shown in green) are displayed on an orthophoto. The property owners for the selected parcels appear at the upper right. The user could then obtain, for example, the conservation value, development potential or conservation priority for each selected parcel and produce a report showing property owner name, acreage of each parcel and the percentage of the property containing the highest conservation priority value. In this manner, a variety of conservation scenarios can be evaluated within the context of available resources.

In addition to this mapping and reporting capability, the web site served as a project information center, providing information, updates and links to related sites. With the Mountain Studies Institute in Silverton being a data warehouse for the San Juan Mountains, it's envisioned that this site will ultimately move to their control.

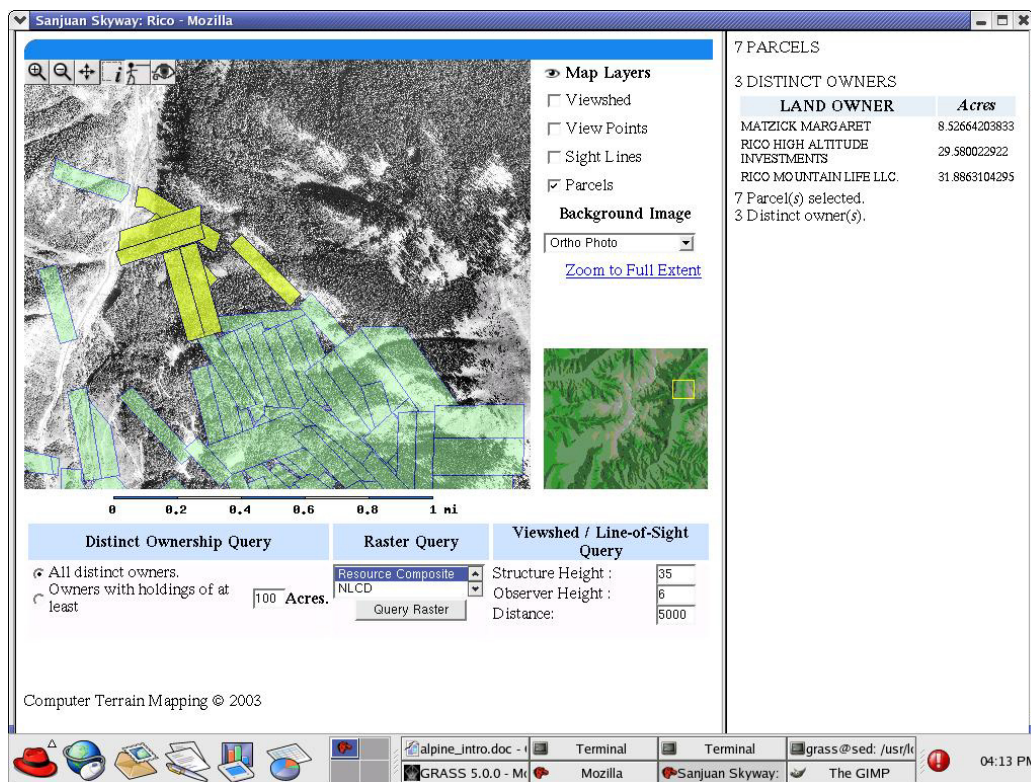


Figure 10. Screen shot from the interactive mapping site.

## DIGITAL VIDEO

To augment and enhance the final report for this project, we've made use of emerging multimedia technologies to create a digital video production. This production describes the overall Skyway setting, project methodology and results, combining still images, video footage, computer animations, narration and music. The result is a captivating presentation that can be viewed on a personal computer or a home television equipped with either a DVD player or VHS tape player.



## RELEVANT DOCUMENTS / REFERENCES

Offices of Community Services, Fort Lewis College, Durango. San Juan Skyway Strategic Framework Plan, January 1998.

Friends of the San Juans Association. San Juan Skyway Corridor Management Plan.

Thompson, Ian. A Historical Touring Guide of the San Juan Skyway. Fort Lewis College, 1994.

San Miguel County Land Use Code, Amended March 23, 2001

Ouray County Master Plan, 1999

Ouray County Land Use Code

Zoning and Land Use Regulations, San Juan County, Colorado, Amended December 11, 2002

Montezuma County Land Use Code, Amended April 8, 2002

Town of Rico Land Use Code, Mar 2003